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Designing a 30 MHz GPU trigger, the LHCb experience

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LHCb will deploy a new fully GPU-based first level tracking trigger in Run 3, processing at 30 MHz (5 TB/s). A close integration with the DAQ and event building allows for a particularly compact system, with the GPUs hosted in the same servers as the FPGA cards receiving the detector data, which reduces the network to a minimum. This architecture also inherently eliminates latency considerations, allowing GPUs to be used despite the very high required throughput. We review the software and hardware design of this system, reflect on the challenges of developing for heterogeneous architectures, and discuss the anticipated performance of the system.

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